

1. A fuel cell electrode catalyst, comprising:  
a carbon supporting structure comprising carbon aerogel, said carbon aerogel having a surface area of greater than about 400 m<sup>2</sup>/g and a pore size of greater than about 4 nm; and  
a plurality of crystals of metal atoms dispersed on said supporting structure, said crystal being about 1 nm to about 4 nm in diameter.
2. The fuel cell electrode catalyst of claim 1, wherein said crystals of said metal atoms are dispersed on internal surfaces of said supporting structure and external surfaces of said supporting structure.
3. The fuel cell electrode catalyst of claim 1, wherein a dispersion rate of said particles of said metal is greater than about 35%.
4. The fuel cell electrode catalyst of claim 1, wherein a dispersion rate of said particles of said metal is greater than about 50%.
5. The fuel cell electrode catalyst of claim 1, wherein a dispersion rate of said particles of said metal is greater than about 70%.
6. The fuel cell electrode catalyst of claim 1, wherein a dispersion rate of said particles of said metal is greater than about 90%.
7. The fuel cell electrode catalyst of claim 1, wherein said crystals of said metal have chemically active surface areas of greater than about 100 m<sup>2</sup>/g.
8. The fuel cell electrode catalyst of claim 1, wherein said crystals of said metal have chemically active surface areas of greater than about 150 m<sup>2</sup>/g.
9. The fuel cell electrode catalyst of claim 1, wherein said crystals of said metal have chemically active surface areas of greater than about 200 m<sup>2</sup>/g.
10. The fuel cell electrode catalyst of claim 1, wherein said crystals of said metal have chemically active surface areas of greater than about 250 m<sup>2</sup>/g.

11. The fuel cell electrode catalyst of claim 1, wherein said cathode catalyst layer has a pore size of said supporting structure of greater than about 15 nm.
12. The fuel cell electrode catalyst of claim 1, wherein said anode catalyst layer has a pore size of said supporting structure of greater than about 15 nm.
13. The fuel cell electrode catalyst of claim 1, wherein said metal is selected from the group of metals consisting of iron, cobalt, magnesium, nickel, titanium, chromium, copper, platinum, gold, silver, rhodium, ruthenium, palladium, iridium, and combinations of the foregoing metals.
14. The fuel cell electrode catalyst of claim 1, wherein said metal is platinum and wherein said supporting structure has a metal content of greater than about 1 wt. % of total catalyst.
15. The fuel cell electrode catalyst of claim 1, wherein said metal is platinum and wherein said supporting structure has a metal content of greater than about 5 wt. % of total catalyst.
16. The fuel cell electrode catalyst of claim 1, wherein said metal is platinum and wherein said supporting structure has a metal content of greater than about 20 wt. % of total catalyst.
17. An MEA for a fuel cell, said MEA comprising:
  - a solid electrolyte membrane; and
  - electrode catalyst layers disposed on said solid electrolyte membrane, said electrode catalyst layers comprising an anode catalyst layer and a cathode catalyst layer;
  - wherein each of said electrode catalyst layer comprises a fuel cell electrode catalyst, said fuel cell electrode catalyst comprising,
    - a carbon supporting structure comprising carbon aerogel, said carbon aerogel having a surface area of greater than about 400 m<sup>2</sup>/g and a pore size of greater than about 4 nm, and
    - a plurality of crystals of metal atoms dispersed on said supporting structure, said crystal being about 1 nm to about 4 nm in diameter.
18. The MEA of claim 17, wherein said solid electrolyte membrane comprises a proton-conducting perfluorinated ionomer.

19. The MEA of claim 17, wherein a pore size of said catalyst supporting structure is greater than about 15 nm for the cathode catalyst layer.
20. The MEA of claim 17, wherein a pore size of said catalyst supporting structure is greater than about 15 nm for the anode catalyst layer.
21. The MEA of claim 17, wherein said metal is selected from the group of metals consisting of iron, cobalt, magnesium, nickel, titanium, chromium, copper, platinum, gold, silver, rhodium, ruthenium, palladium, iridium, and combinations of the foregoing metals.
22. The MEA of claim 17, wherein said electrode catalyst is deposited onto said solid electrolyte membrane as paste, slurry, or ink, said paste, slurry, or ink being in the form of a powder and a binder.
23. The MEA of claim 22, wherein said electrode catalyst is deposited onto said solid electrolyte membrane to a thickness of less than about 100  $\mu\text{m}$ .
24. The MEA of claim 22, wherein said electrode catalyst is deposited onto said solid electrolyte membrane to a thickness of less than about 20  $\mu\text{m}$ .
25. The MEA of claim 22, wherein said electrode catalyst is deposited onto said solid electrolyte membrane to a thickness of less than about 10  $\mu\text{m}$ .
26. The MEA of claim 17, wherein said fuel cell is a PEM fuel cell.
27. The MEA of claim 17, wherein said fuel cell is a DM fuel cell.